body 5.5–6 mm. long, 1.2–1.7 mm. wide, obliquely slender fusiform, with about 9 prominent, longitudinal ribs; stigma 0.4–3 mm. long. (Fig. 1.)

Perenne 30–48 cm. altum, caule glabro angulato, foliis biternatis, foliolis 8–16 mm. longis tenuiter chartaceis suborbicularibus vel late rhomboideis subtus glanduloso-puberulis apicibus lobatis, inflorescentibus foemineis cymosis 3–5-floriferis; acheniis fusiformibus stipitatis.

Washington: in meadows, altitude 6000 feet, Mount Rainier, August, 1895, *C. V. Piper 2022* (type in State College of Washington Herbarium, Pullman).

No similar species is known in the region. The closest relative seems to be *T. stipitatum* Rydb. (not *T. stipitatum* Rose, 1903), a native of the mountains of Colorado. It has the herbage glabrous, and the achenes about 6 mm. long, and 2.5–3 mm. broad. *T. rainierense* has the leaflets capitate glandular puberulous beneath, and the achenes 5.5–6 mm. long, and 1.2–1.7 mm. wide.

University of Hawaii, Honolulu,
February 7, 1937.

SEEDLINGS FROM POLYEMBRYONIC SEEDS OF EUGENIA HOOKERI

Arthur M. Johnson

In a previous paper[1] the writer described an unusual polyembryonic condition found in the seeds of *Eugenia Hookeri,* a common ornamental tree in the Los Angeles area. The question naturally followed as to whether or not seedlings would develop from these embryos and what form the seedlings would take. The present paper deals with the results obtained from seeds that were allowed to germinate in the soil under the parent tree. The species produces an abundant crop of fruit annually in this locality, and if the fallen fruits are allowed to remain on the ground a good crop of seedlings will usually spring up.

The seedlings herein described were dug up on May 26, 1934. The parent tree stands within a few feet of the north side of a dwelling, where, except during the midsummer season, no direct sunlight falls upon the ground beneath it. The soil is clayey and is always moist, and frequently wet, especially on days when the adjacent lawn is watered.

At the time these seedlings were collected numerous other seedlings were growing in the ground beneath the parent tree. Many more seedlings were examined than the ones here described and figured. Seedlings have appeared annually in varying numbers since these were collected, though at the present

[1] Johnson, A. M. Polyembryony in *Eugenia Hookeri.* Amer. Journ. Bot. 23: 83–88. 1936.

writing there are relatively few, owing perhaps to the recent long cold spell.

One peculiarity of these seedlings is that they have never developed further than to a height of about a decimeter. The past summer (1936) a number of seedlings, all less than a decimeter in height, were transplanted to a more favorable location, in drier soil, where they would be exposed to direct sunlight for the greater part of the day. Up to the present they have made no growth, although they are all as green and healthy looking as when planted. It remains to be seen whether they will resume growth after the advent of the warm season.

The thirteen seedlings illustrated (Pl. XIX) were selected from a representative lot of twenty-eight, which were growing in scattered clusters in the shade beneath the parent tree. The tallest specimen (Pl. XIX, fig. A) was 7.5 centimeters in height, measured from the cotyledonary node to the uppermost visible node. The most vigorous specimen (Pl. XIX, fig. C,—drawn on a larger scale for the sake of a clearer presentation of certain details) measured 7 centimeters in height. Seedlings from the

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Explanation of the Figures. Plate XIX

A. Normal seedling from a medium-sized embryo with unequal cotyledons. Shoot 7.5 cm. in height.

B. Twin seedlings from a 3-cotyledonous embryo. Seedlings connate at the cotyledonary node. Cotyledons very unequal; *t,* testa; *a, b, c,* cotyledons.

C. Vigorous seedling from the largest embryo of a seed. Shoot forking at second epicotylary node. Twin primary roots.

D. Seedling from a large embryo. Twin primary roots.

E. Interlocked seedlings (*x, y*) from two embryos of the same seed; *x,* two unequal shoots from the epicotyl of the smaller embryo, the cotyledons of which are *a, b, c,* and the primary root, *r; y,* well developed shoot from the larger embryo, the cotyledons of which are *d, e, f,* and the primary root, *s.*

F. The smaller seedling of Fig. E, showing the two shoots, *x,* springing from the epicotyl, the three unequal cotyledons, *d, e, f* (corresponding to *d, e, f* in fig. E), and the forking primary root, *r.*

G. Opposite side of the seedling shown in fig. F, with the cotyledons correspondingly labeled.

H. Part of the larger seedling, *y,* of fig. E, showing the three unequal cotyledons (labeled correspondingly).

I. Normally developed seedling from one of the larger embryos of a seed, with unequal polyhedral cotyledons.

J. Seedling from one of the smaller embryos, with twin primary roots. Cotyledons unequal and polyhedral.

K. Seedling from a large embryo, with two unequal and arrested primary roots.

L. Young normal seedling from a large embryo. Cotyledons nearly equal in size but of irregular shape.

M. Part of a large seedling from a large embryo. Closely appressed against its cotyledons is a small seedling from a minute embryo of the same seed; *a,* epicotyl; *r,* part of the primary root; *c,* the cotyledons of the larger embryo, closely appressed against each other on one side of the seedling; *s,* cotyledons of the smaller embryo.

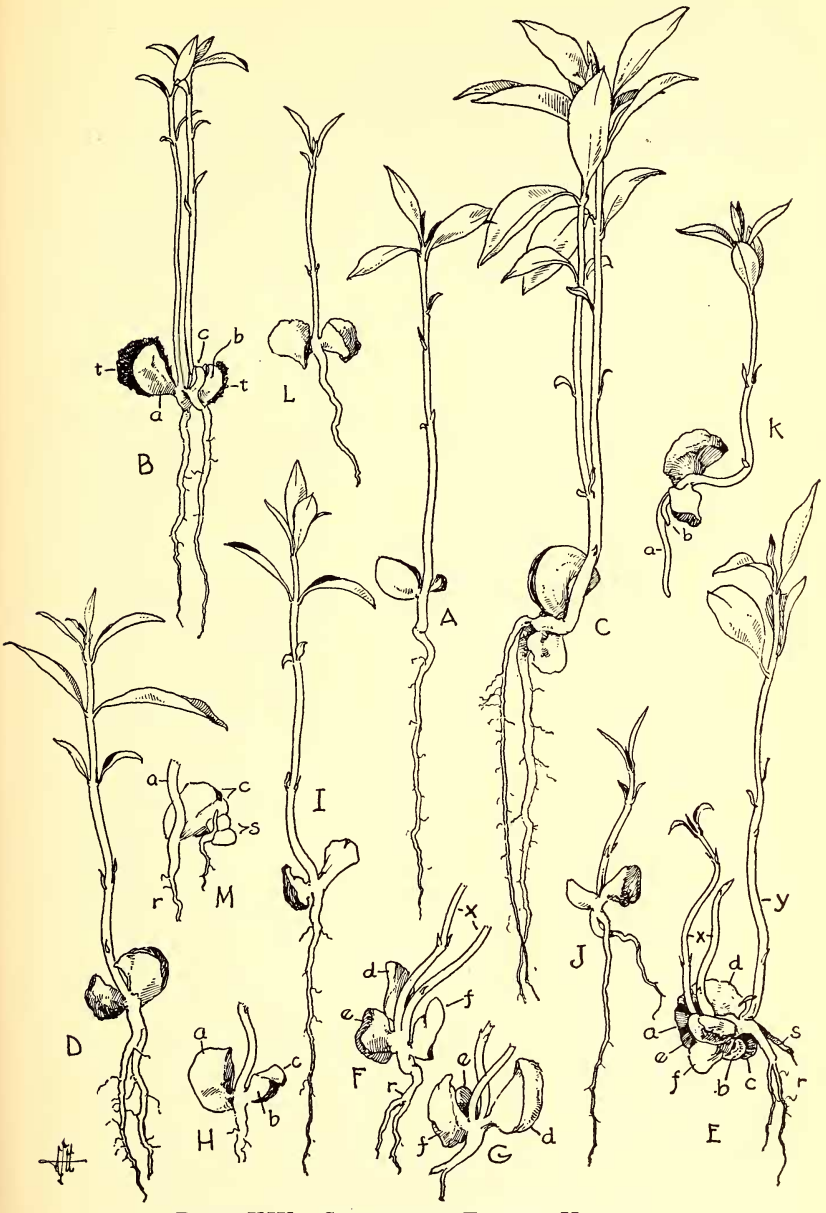

PLATE XIX. SEEDLINGS OF EUGENIA HOOKERI.

smallest embryos were but a few millimeters in height; one such specimen, 12 millimeters in height, is shown (Pl. XIX, fig. J).

Of these twenty-eight seedlings, six had large cotyledons of unequal size. In five others the cotyledons were small, and in the remaining seventeen seedlings the cotyledons were of intermediate size. The size of the cotyledons, however, did not appear to have had any bearing on the size of the seedlings. It should be remarked in passing that the cotyledons are hypogeal, and that the extreme differences in size and shape is due to their close packing in the seed. Cotyledons of equal size in the same embryo are not uncommon, although more frequent in smaller embryos than in larger ones. Tricotyledonous embryos are also not infrequent, and some seedlings from such embryos are herein figured and described.

The primary root was in general well developed,—to the length of the shoot or longer (Pl. XIX, figs. A, B, C). But in some instances it was remarkably short, as if arrested early in its development. In one small seedling in particular two such primary roots were present, but were very unequal in length (Pl. XIX, fig. K). There were several seedlings with twin primary roots of considerable length, more or less equally developed. (Pl. XIX, figs. C, D, J.) In these cases only a single shoot had developed from the epicotyl. In one instance, a small tricotyledonous seedling interlocked with a larger one, twin shoots arose from the epicotyl, and the primary root forked into two approximately equal branches a short distance from the tip of the hypocotyl. The three cotyledons and the twin shoots suggest a condition of connate embryos (Pl. XIX, figs. E, F, G). But a clearer case of twin seedlings, each with its distinct primary root, was found, in which the twins were connate at the cotyledonary node only, and in this case there were also three cotyledons present (Pl. XIX, fig. B). Interlocked seedlings, as might be expected under the circumstances, were not uncommon, and most of them were difficult to separate in order to determine to what extent, if any, they were connate. It was especially difficult in the case of seedlings from the small embryos. In the vigorous seedling already mentioned (Pl. XIX, fig. C) the shoot forked at the second node above the cotyledonary node, the branches being equally well developed.

Seedlings which showed none of the pecularities above described were frequent. These may be said to be normal, except that the cotyledons were frequently very unequal in shape and size (Pl. XIX, fig. A, I, L). In every seedling examined the lower leaves were minute scale-like organs.

University of California at Los Angeles,
March, 1937.